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THREE DIMENSIONAL ECHOCARDIOGRAPHIC ANATOMIC INTELLIGENCE APPROACH FOR FULLY AUTOMATED SIMULTANEOUS QUANTIFICATION OF LEFT VENTRICULAR AND ATRIAL VOLUMES

Poster Contributions
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Background: Although 3D echocardiography (3DE) allows accurate and reproducible quantification of cardiac chambers, it has not been embraced in clinical practice because it relies on manual input, which interferes with workflow. We tested a newly developed fast, fully automated algorithm based on anatomic intelligence approach for simultaneous quantification of both left ventricular and atrial (LV, LA) volumes. We hypothesized that this algorithm could yield measurements comparable to those obtained using standard semi-automated 3DE technique, which would also agree with cardiac magnetic resonance (CMR) values.

Methods: Initially, the software was trained on 150 patients to optimize the position of the endocardial boundaries by matching it to manually traced 3DE and CMR images. Then we studied 152 patients with a wide range of LV volumes, who underwent transthoracic 3DE (Philips). Images were analyzed using the new software to obtain LV end-diastolic and end-systolic volumes (LVEDV, LVESV), ejection fraction (EF) and maximal LA volume (LAV), which were validated in 2 protocols. Protocol 1 included 94 patients whose automated measurements were compared to those obtained using conventional 3DE software (QLAB, Philips). Protocol 2 included 58 patients whose measurements were compared to CMR reference values (1.5 Tesla, Philips).

Results: Analysis time was 42±1sec for the automated technique and 121±6 sec for the conventional 3DE analysis. Inter-technique comparisons showed strong correlations (LVEDV: r=0.94, LVESV: r=0.94; LVEF: r=0.77; LAV: r=0.93) and small biases (LVEDV: -7±24ml, LVESV: -2±25ml; LAV: +8±20ml; and EF: -2±12%). Comparisons with CMR also showed strong correlations (LVEDV: r=0.96, LVESV: r=0.95; LVEF: r=0.86; LAV: r=0.83)with larger inter-modality biases (LVEDV: -25±22ml, LVESV: -14±29ml; LAV: -25±23ml; EF: -3±10).

Conclusion: The new, fully automated 3DE software allows simultaneous measurements of both LV and LA volumes, comparable to those obtained using conventional semi-automated 3DE technique, with the advantages of faster analysis and complete reproducibility, which are accurate against CMR reference.